

R·I·T

Semiconductor & Microsystems

Fabrication Laboratory

Title: Suss MJB4 Mask Aligner

Revision: A

Rev Date: 6/18/2021

Approved by:

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Process Engineer

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Equipment Engineer

1 SCOPE

The purpose of this document is to detail the use of the SUSS MJB4 Mask Aligner. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

2 REFERENCE DOCUMENTS

- Appropriate Tool Manuals

3 INSTRUCTIONS

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4 TOOLS AND MATERIALS

4.1 General Description

The SUSS MJB4 Mask Aligner is a broadband exposure tool. The features on the mask will print the same size on the wafer (1:1) so, stepper masks will not work on this aligner. The tool can handle substrates ranging from a 4" wafer down to small pieces.

5 SAFETY PRECAUTIONS

5.1 Hazards to the operator

- 5.1.1 During exposure, the microscope stage will move forward by a few inches after two indicator sounds. Exercise caution and pull seat backwards to avoid injury.

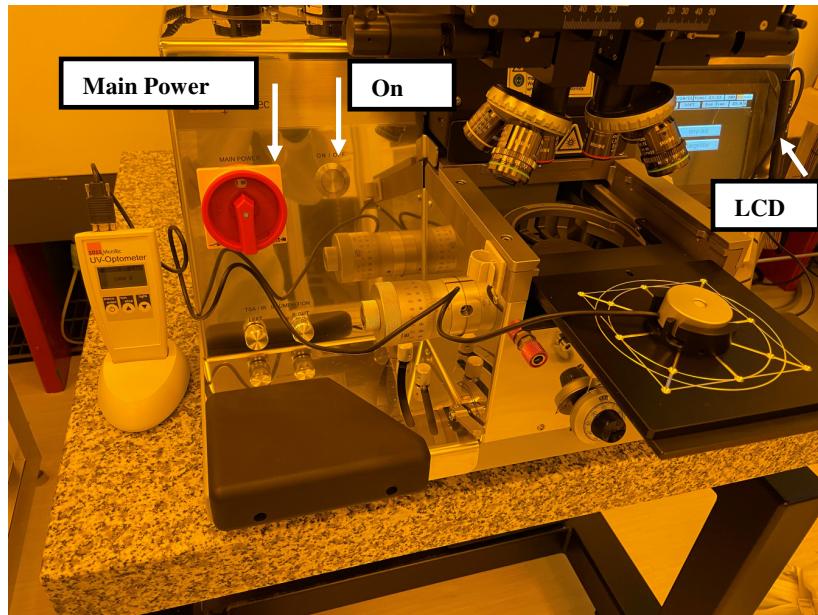
5.2 Hazards to the tool

- 5.2.1 Handle the mask holders and stage chucks with proper care. Improper handling will damage parts. Return all accessories packed in bubble wraps to their appropriate storage drawers.
- 5.2.2 Do not attempt to open the lamp housing.

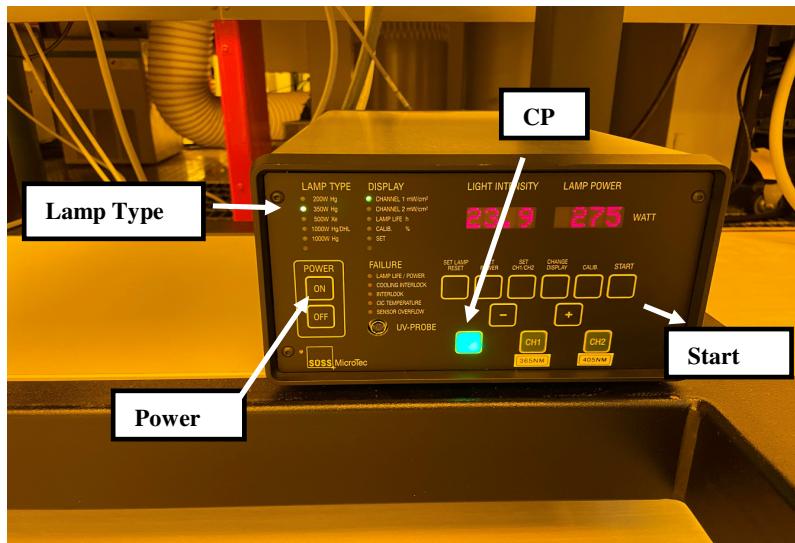
6 INSTRUCTIONS

6.1 Turning the MJB4 Mask Aligner System ON:

1. Turn on the compressed air, nitrogen, and vacuum service chase. The tool is interlocked with vacuum i.e., the tool vacuum will not turn on unless swiped in (card swipe 2).
2. Turn the main power on by rotating the red knob from OFF position to **ON** position. Wait until the LCD display on the right of the machine shows ‘start machine with ON/OFF button’.



3. Make sure the Lamp cooling, Vac, N2 LEDs are all in green.
4. Turn on the Lamp power supply unit located under the tool by pressing the **ON** button on the control panel. Make sure the lamp type highlights '350W Hg'. Do not proceed if other power settings were chosen – this will cause significant damage to the lamp.



5. Select the **Constant Power (CP)** mode by pressing the CP button on the lamp power supply unit.
6. Wait until START appears in the digital display and press the **Start** button.

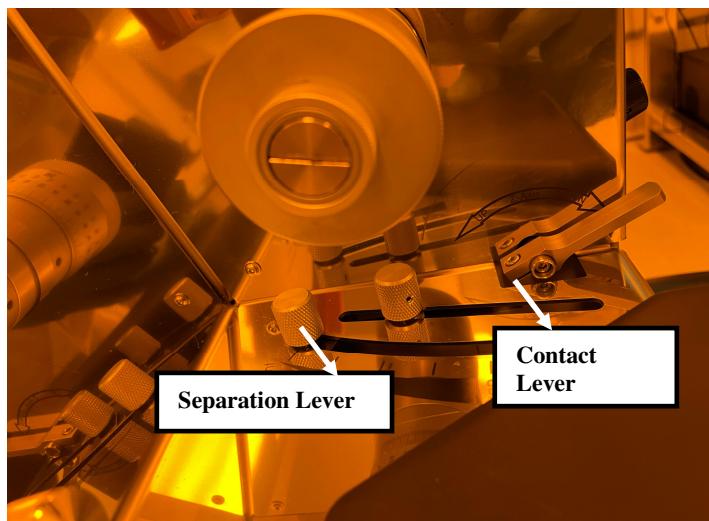
7. The digital display should now display **LAMP COLD**. Wait for several minutes till the digital display shows 0.0 (Light intensity) and 275 Watt (Lamp Power). Wait for an additional 15 minutes for the lamp to stabilize before proceeding to the next step.

NOTE: Failure to follow the procedure will affect the alignment resolution and will reduce the lamp's lifetime.

6.2 Performing the Lamp Test

1. From the home screen, touch Main Menu using the attached stylus.
2. Touch the **Lamp/Filter** button and touch the lamp test button.
3. Follow the instruction on screen to close the contact lever. Make sure the separation lever is at contact (**cont**) position. Slowly push the lever forward until it stops at the Up position (a click should be heard and felt). Quickly move away from the microscope to avoid being hit. Do not look into the UV light directly.

Note: Parts will be damaged if the contact lever is pushed quickly.



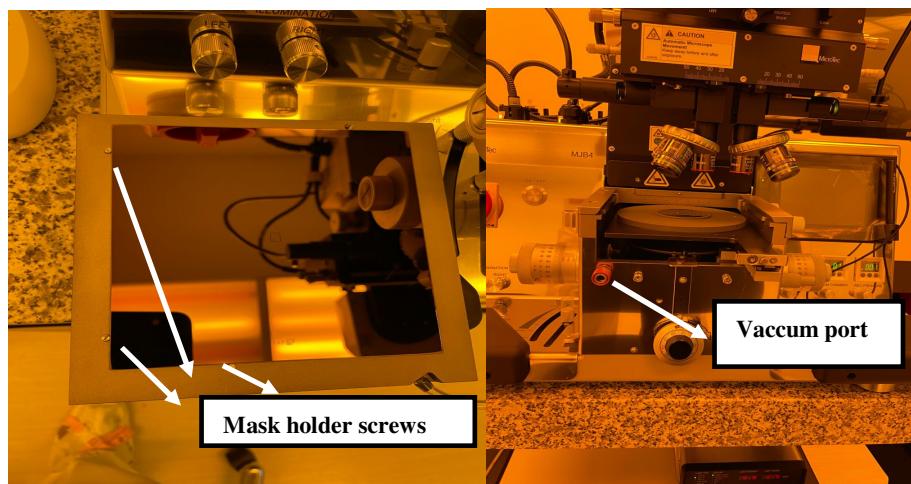
4. Write down the light intensity displayed on the **power supply** under the table. This should be used to calculate the exposure time. Intensity as on 4/26/21 is 23.5 mW.
5. Once the lamp test is done, follow instructions on the touch screen to open the contact lever. Slowly pull the lever back to **down** position. The microscope will slide black to position.

Note: Do not force the contact lever to move if it seems stuck. Keep an eye on the separation lever – it needs to be in contact (**cont**) position.

6. On the LCD screen, click the back arrow to return to the main screen.

6.3 Loading the Mask

1. The mask holder with different apertures can be found inside the accessories cabinet (bottom). Carefully get the required holder out of the bubble wrap.
2. Connect the mask holder to the tool vacuum port in front. Gently push the tube's connector into the port. It should lock itself in place.
3. On the LCD screen ensure that the mask vacuum is off.
4. Place the mask with chrome side up on the mask holder and make sure that the edges of the mask are pressed against three screws on the sides of the mask holder.

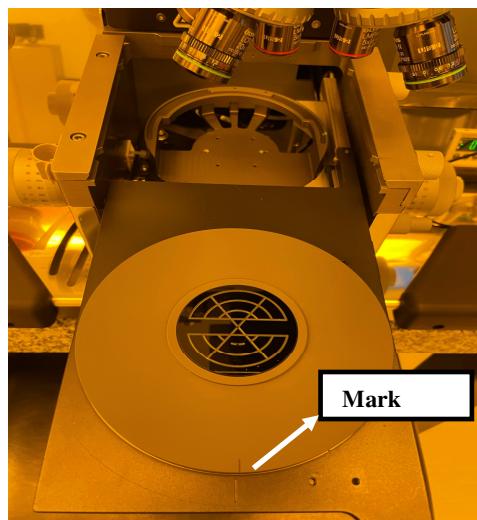


Note: Ensure that the mask field area is clean.

5. Turn the vacuum on by pressing the '**turn mask vacuum on**' button on the LCD screen. Double check to see if the mask is held down by vacuum.
6. Gently flip the mask holder (chrome side faces down now) and slowly slide it in the tool stage area. Fix the mask in place by hand tightening the screws on the side.

6.4 Loading the Substrate

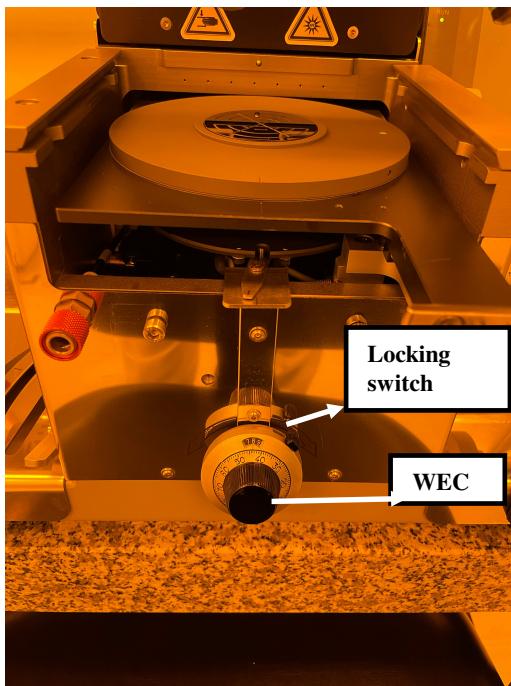
1. Wafer holder chucks are stored in the accessories cabinet (top drawer).
2. Slowly pull the wafer holder stage out until it stops. Position the wafer holder such that the marker on the chuck line aligns with the line marker on the holder stage.



3. Place the wafer on the holder. Use flat for reference.
4. Press and hold the vacuum screw button located on the right edge of the wafer holder frame and gently slide it in. Release the vacuum screw button.

6.5 Wedge Error Compensation (WEC) Setting

1. WEC adjustment needs to be done every time a **new** substrate with a **different** thickness is loaded. This needs to be done after loading the wafer/substrate and before the alignment procedure and the final exposure. Note: the lever should be in **up** position for WEC adjustments. Read below instructions.
2. Select the WEC settings option from the main menu on the LCD screen.
3. Follow the screen instructions to close the **contact lever**. Make sure that the separation lever is in **cont** position before lifting the contact lever up. Move it slowly to the up position.
4. Unlock the thickness setting knob (12) by moving the locking switch to the right. This switch is located on the top-right of the thickness setting knob.



5. The screen should now display '**Adjust WEC to the left <up>**'. Following this, rotate the thickness setting knob slowly to the up position (counterclockwise). Turn the knob slowly to avoid the wafer pushing/crashing on to the mask.
6. Continue turning the thickness setting knob counterclockwise several turns until the screen displays '**Adjust WEC to the right <down> until ok**'.
7. Follow the screen instructions to '**Adjust WEC to the right <down> until ok**' and slowly turn the thickness setting knob to the down position (i.e., in the clockwise direction).
8. After a few turns, the screen should now display, '**WEC setting OK, Open contact lever**'
9. Lock the thickness setting knob with the locking lever located at the top right side of the thickness setting knob and follow screen instructions to slowly pull the contact lever back to the down position and return back to the main menu.

6.6 Mask alignment and Exposure

Note: This mask aligner does not support vacuum contact. It is recommended to use hard contact mode for best resolution.

1. Creating a new recipe:

- a. Press the **Recipes** option on the Main menu screen to enter into the recipe editor mode. Touch the blank screen to enable 'New' button at the bottom.
- b. Press the **New** button to display the on-screen keyboard. Hit the **clr** button and enter the new recipe name. Press **enter** to go back to the recipe editor screen.
- c. Highlight the new recipe and touch **view** button at the bottom to check the parameter settings.
- d. Close the parameter info window to go back to the recipe editor screen

2. Changing parameters in recipe

- a. Highlight the recipe in recipe editor screen and press the load button on the bottom right corner of the window.
- b. The main menu will now have the loaded recipe name highlighted with a green background. Press the parameters button.
- c. Edit the desired parameters. Press load to go back to the main menu with the saved parameters.

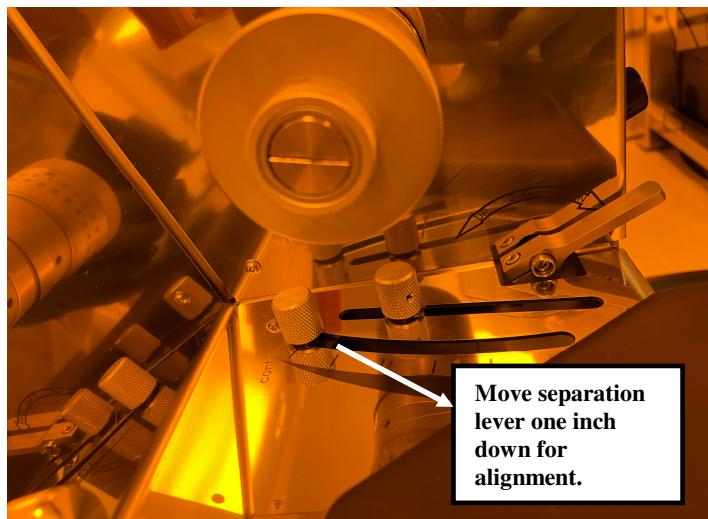
3. Parameter description

- a. Option 1 has the following:
 - i. Align + Exp, is the standard align and expose.
 - ii. Test Exp, allows exposure with & without alignment and allows the user to select the desired contact mode.
 - iii. Flood Exp, allows blanket exposure without alignment and contact mode settings.
- b. Option 2 allows the user to select the desired contact mode from the following:
 - i. Hard contact
 - ii. Soft contact
 - iii. Gap Exposure

- c. Option 3 allows the user to select the optics mode
 - i. Reflected light
 - ii. IR mode for backside alignment
- d. Option 4 allows settings for selecting the vacuum chuck or contact chuck. **Note:** the tool does not have provisions for vacuum contact, so, always select the contact '**Cont**' chuck.
- e. Hard contact time – recommended 4s
- f. Exposure time – recommended standard 11s.
 - i. Exposure time = Required dose/ measured light intensity

4. Alignment & Exposure

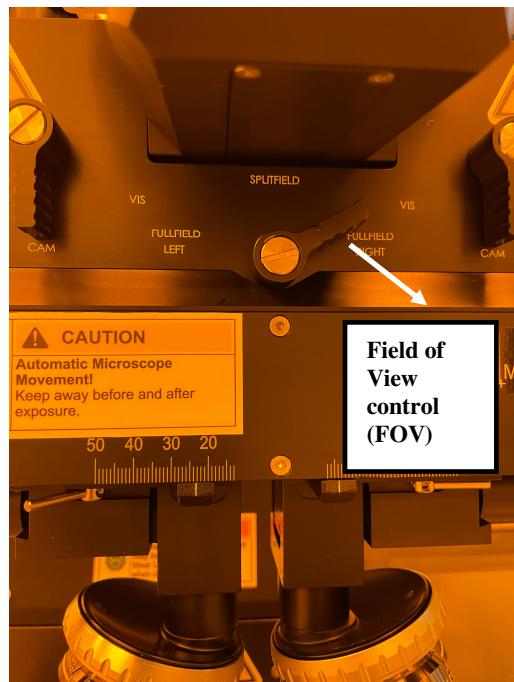
- a. Make sure the separation lever is in '**Cont**' position after the WEC adjustment. If not, slowly push it all the way forward.
- b. Slowly push the contact lever to the '**Up**' position.
- c. On the screen, the exposure command will appear.
- d. For executing the alignment, move the separation lever down by one level from the '**cont**' position. Failure to do this will result in mask damage. The photoresist film will also be affected.



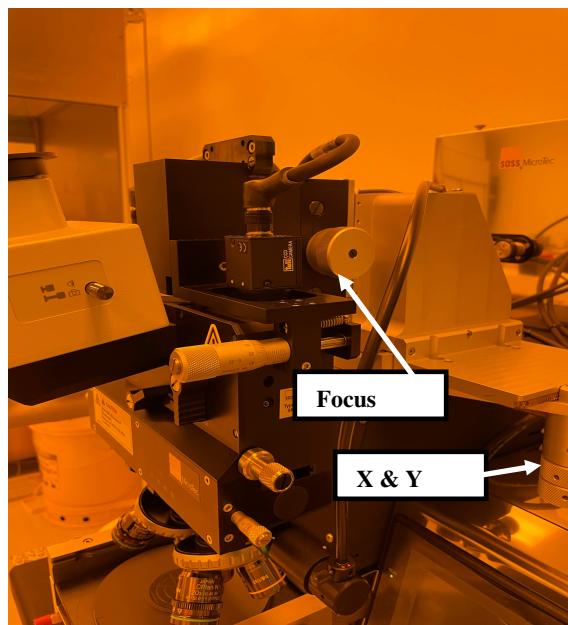
- e. The alignment menu should show up on the screen.
- f. Turn the illumination knob to the right to find mask patterns on the monitor. Adjust the coarse focus to get optimal focus on the mask features. Note: the image in the eyepieces are rotated by 180 degrees.

Note: the microscope position should not be adjusted when the microscope is up i.e. the contact lever should be in 'Up' position.

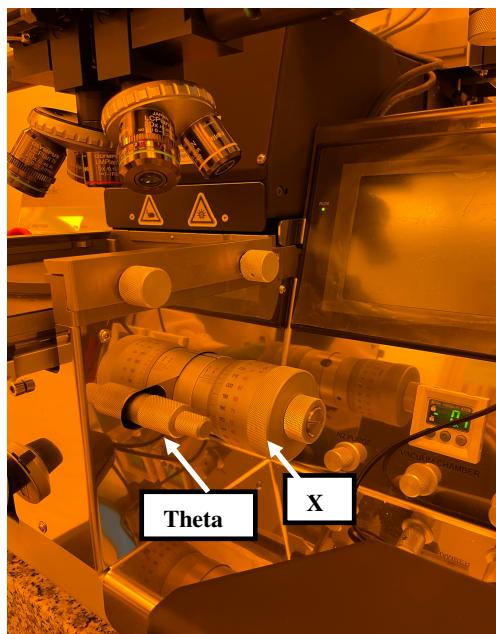
- g. Select the desired magnification by moving the objectives manually.



- h. For the fine focus, use knobs on both sides of the microscope to correct the focus.
- i. The x movement of the objectives can be controlled by rotating the micrometer knob on the sides of the microscope. Note that the minimum separation both the objectives can have is 32 mm. The Y axis movement can also be controlled by adjusting the knob.



- j. Align the substrate to the desired alignment features on the mask by using the X, Y and theta knobs on the stage.



- k. After alignment, push the **separation lever** to **cont** position. The exposure menu should appear. Use the alignment check option to allow the system to verify the alignment on hard contact mode.
- l. Execute the exposure & select yes on the screen. The microscope assembly will automatically move forward after a two beep sounds. Step away from the tool and do not stare directly into the UV light.
- m. Adjust the theta, X, Y (for X & Y, revert to 10 on the micrometer) and WEC back to default values (in the case of thick substrates)
- n. After the tool finishes the exposure, move the contact lever to '**down**' position. The LCD screen should now display the main menu.

5. Unloading the mask and substrate

- a. Press and hold the vacuum hold knob on the wafer holder and slowly slide it all the way out.
- b. Remove the substrate and push the wafer holder back in.

- c. Gently pull the mask holder out, flip it and lay it down on the side arm.
- d. On the screen, press and hold ‘**Mask vacuum on**’ for few seconds until it changes to ‘**Mask vacuum is off**’.
- e. Remove the mask and slide the mask holder back into the stage.

6.7 Shut down

Note: The tool can be left on during weekdays.

- f. Turn off the microscope illumination by turning the knobs counterclockwise until they stop.
- g. Press the **off** button on the lamp power supply to switch to standby status.
- h. Press and hold the machine ON/OFF button until the screen displays the countdown timer from 600 seconds.
- i. Wait for 10 minutes until for the lamp to cool. The screen should now display ‘start machine with ON/OFF button’.
- j. Turn off the main power by turning the red dial switch from ON position to **OFF** position.
- k. Close the N2, Compressed air and vacuum valves in the service chase.

REVISION RECORD

Summary of Changes	Originator	Rev/Date
A	Venkatesh Deenadayalan	6/18/21